TABLE 3.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during March, 1930*

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,868 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (40 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°	
Surface	N 63 W	1.5	S 55 W	1.2	N 71 W	4.8	S 81 W	1.9	N 40 W	3.2	S 29 W	0.9	S 80 W	1.3	N 63 W	1.6	S 66 E	1.1	N 71 W	1.0
500	S 89 W	2.5	S 71 W	4.6			N 88 W	5.9	N 44 W	3.8	S 60 W	2.2			N 61 W	4.0	S 28 E	2.3	S 83 E	1.9
1,000	N 80 W	5.6	S 87 W	6.3			N 87 W	6.8	N 44 W	6.8	N 76 W	3.9	S 78 W	4.3	N 79 W	7.1	S 12 W	3.3	E	3.0
1,500	N 61 W	6.1	N 74 W	9.6			N 79 W	8.1	N 39 W	8.8	N 57 W	6.1	N 81 W	7.6	S 86 W	9.2	S 42 W	5.6	N 75 E	2.5
2,000	N 60 W	7.0	N 68 W	11.3	N 70 W	7.7	N 77 W	10.0	N 41 W	9.4	N 64 W	7.8	N 63 W	7.9	S 88 W	11.7	S 65 W	7.0	N 56 E	2.1
2,500	N 58 W	9.2	N 70 W	14.4	N 56 W	12.0	N 81 W	10.4	N 41 W	11.0	N 64 W	8.2	N 61 W	8.2	S 84 W	14.1	S 67 W	8.4	N 42 E	2.5
3,000	N 56 W	10.6	N 78 W	14.5	N 51 W	11.6	N 77 W	11.8	N 40 W	9.2	N 72 W	9.8	N 56 W	9.3	S 82 W	17.8	S 81 W	8.4	N 13 E	1.2
4,000	N 72 W	9.1	S 87 W	12.8	N 50 W	6.9	N 87 W	18.5	N 40 W	12.8			N 33 W	7.8			N 83 W	11.4	N 17 W	3.2
5,000							N 88 W	18.6	N 30 W	9.4							N 74 W	11.6		

Altitude (meters) m. s. l.	Medford, Oreg. (446 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (313 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,280 meters)		San Francisco, Calif. (60 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Washington, D. C. (5 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°	
Surface	S 26 E	0.5	S 72 W	2.0	N 11 E	1.0	N 36 W	1.8	N 88 W	1.5	S 20 E	1.1	S 59 E	1.3	N 20 W	0.8	S 63 E	0.9	N 85 W	2.0
500	S 38 W	0.4	N 86 W	6.6	N 41 W	4.0	N 47 W	3.8	N 87 W	5.5			N 19 W	0.9	N 11 W	2.2	N 67 W	1.2	S 88 W	6.7
1,000	S 4 E	0.6	N 72 W	8.4	N 43 W	6.0	N 51 W	7.8	N 73 W	6.5			N 19 E	3.0	N 33 W	5.8	N 22 W	1.4	N 85 W	8.1
1,500	N 83 E	0.5	N 67 W	9.9	N 57 W	7.3	N 45 W	7.9	N 76 W	9.1	S 3 E	1.8	N 19 E	2.7	N 39 W	7.3	N 49 W	1.0	N 81 W	10.5
2,000	N 24 W	1.2	N 59 W	11.5	N 75 W	8.5	N 41 W	9.2	N 79 W	11.1	S 70 W	1.8	N 26 E	3.9	N 28 W	6.4	N 36 W	1.0	N 80 W	10.7
2,500	N 29 W	3.2	N 54 W	11.7	N 81 W	11.8	N 49 W	11.4	N 76 W	13.8	N 88 W	3.4	N 35 E	1.8	N 30 W	5.6	N 13 W	2.0	N 84 W	11.0
3,000	N 23 W	4.7	N 67 W	9.3	N 82 W	11.6	N 52 W	11.1	N 79 W	13.7	N 69 W	5.1	N 44 W	1.4	N 29 W	8.2	N 29 W	2.0	S 77 W	12.5
4,000	N 25 W	9.6					N 52 W	8.8	N 74 W	15.9	N 59 W	5.8								

TABLE 4.—*Observations by means of kites, captive and limited-height sounding balloons during March, 1930*

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes (meters) m. s. l., reached during month	3,133	2,644	3,207	2,946	3,092
Maximum altitude (meters) m. s. l., reached and date	[1] 5,031	[2] 5,369	[3] 5,385	[4] 4,485	[1] 5,924
Number of flights made	35	37	36	32	32
Number of days on which flights were made	31	29	31	26	31

[1] 9th. [2] 31st. [3] 19th. [4] 17th.

In addition to the above there were approximately 125 pilot balloon observations made daily at 53 Weather Bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

The weather for March, 1930, was warm for the season during the first half, but the latter half in many portions was decidedly cold; and while March is normally much warmer than February, this year the month, as a whole, in many interior and southern sections was actually colder than February, which had been abnormally warm.

The precipitation for the month was unevenly distributed. From two to more than four times the normal was received in portions of the Southeast, while more than normal amounts fell in portions of Texas, the far Southwest, and the northeast section; but only scanty falls were received in most interior valley sections, the northern Great Plains, the mid-West, and the Pacific Northwest.

PRESSURE AND WINDS

At the beginning of the month a low-pressure area was central over the upper Lake region, accompanied by moderate precipitation throughout that region, and also over the northern portion of the Mississippi Valley, the same being largely in the form of snow. Light rain also prevailed over much of the South Atlantic and portions of the east Gulf States. During the next few days these precipitation areas moved off the northeast coast, and were followed by generally fair and moderately cool weather over most of the country, except in portions of the central and southern Pacific coast areas, where rain occurred almost daily.

On the 6th a rather extensive low-pressure area extended over the Great Plains region from western Texas to the northern border States, and precipitation prevailed over most sections to the westward of the Rocky Mountains and from the lower Lakes northeastward. By the next day this storm had moved to the southern Ohio Valley, and widespread precipitation prevailed from the central Mississippi Valley southward, also to the Atlantic, and was accompanied by heavy thunderstorms in many localities. Light precipitation prevailed also over much of the region from the northern portions of New Mexico and Arizona to the northern border States, and likewise in the western portion of Washington. During the next

two days this eastern storm moved off the northeast coast, causing widespread precipitation throughout the East and frequent thunderstorms and heavy rainfalls.

On the 10th a low-pressure area extended from the upper Lake region southwestward to western Texas, and on the 11th was central over the Great Lakes, accompanied by light precipitation throughout the Lake region and southward, east of the Mississippi River, to the Gulf; and during the next day this area moved out the St. Lawrence Valley, with light precipitation prevailing throughout most of the Eastern States.

About the middle of the month high pressure prevailed over most northern and central areas east of the Rocky Mountains, and was accompanied by generally fair weather, but light rain fell throughout much of the South, the extreme northern Rocky Mountain region and the South Pacific area, and during the next several days moderate to light precipitation prevailed over most sections of the country. By the 19th precipitation overspread much of the East with some heavy falls in the South and Southeast. On the 20th and 21st much colder weather moved in from the Northwest, and during the next several days a series of low-pressure areas developed in the West and Southwest and moved easterly and northeasterly, accompanied by precipitation over much of the eastern half of the country, the falls being moderately heavy in many sections.

On the 28th a precipitation area overspread much of the southern half of the Gulf States and moved easterly, then northeasterly along the Atlantic coast, and was accompanied by heavy rain in some localities near the coast. The month closed with generally high pressure and fair weather throughout the East, but relatively low pressure in the upper Lake region and the southern plateau and South Pacific regions, though with light precipitation in only a few localities.

The month was noted as rather windy at many stations, as is usual during March; but except for the moderate tornadoes that visited portions of the Gulf States on the 6th there were few storms of sufficient intensity to cause damaging winds over extensive areas, and wind damage was rather infrequent, as shown by the comparatively few instances recorded in the table at the end of this section.

The distribution of the monthly means of pressure is graphically shown in Chart VI, while the departures from the normal and changes from the preceding month are likewise shown in the insets of Charts II and III.

TEMPERATURE

The warm weather that prevailed during much of February continued quite generally during the first half of March, but from about the 18th onward to the end of the month temperature lower than normal for the latter part of March was the rule. As a whole, the month was cool in the South and in the Ohio Valley, but moderately warm in most of the North and practically all of the far West.

The first decade was mainly warmer than normal, especially in the north-central and northeastern portions, but was somewhat cooler than normal in the south-central and southeastern districts, while beginning cold in the Rocky Mountain and Plains regions where warmth soon replaced the cold weather.

The week from the 11th to the 18th was decidedly warm, as a whole, especially in the central valleys, the upper Mississippi Valley, and most of the Missouri Valley, but was slightly cooler than normal along the Gulf coast and in most parts of the Pacific States.

About the 19th there was reaction to colder weather in the Great Plains, and low temperatures soon overspread most central portions of the country, reaching the Eastern States only about the 22d. To eastward of the Mississippi River the freezing weather did not extend farther south than the lower Ohio Valley and western North Carolina, but considerable portions of the Southwest reported temperatures many degrees below freezing.

The closing fortnight was generally cooler than normal, notably in the Mississippi Valley and the Lake region and from the southern Rocky Mountain region eastward to the South Atlantic coast. In the middle Rocky Mountain region and the middle and northern Plains the weather was mainly warm from the 21st to the 25th, but cold after the 25th. To westward of the Divide and in some Atlantic coast districts north of Chesapeake Bay this fortnight was warmer than normal, the districts from central California to Puget Sound having especially mild weather after the 24th.

The month averaged warmer than normal along the Canadian border, also near the middle Atlantic coast, in the upper Mississippi and middle and upper Missouri Valleys, in nearly all parts of the Plateau region, and especially in the Pacific States. The month was decidedly cooler than normal in all States that touch the Gulf of Mexico, and the tendency to temperatures below normal prevailed as far north as the interior of Maryland, the Ohio Valley, Missouri, Kansas, and southern Wyoming, also as far as the lower Colorado River.

The highest temperatures were usually recorded about the middle of the month from the Plains States eastward, though at scattered dates in the Gulf States, while in the far West and the southern Rocky Mountain region they usually occurred during the last week. Practically throughout the country they were many degrees below the highest marks of March in previous years, and this was particularly the case to eastward of the Mississippi River. The highest temperature reported was 104° in southern Texas on the 6th.

The lowest marks occurred generally during the first five days, but in the southern Rocky Mountain region they occurred about the 28th. They were almost invariably well within the limits shown by other years. The lowest reported was −31° at an elevated station in Colorado, but points in Wyoming and Montana reported −30°.

PRECIPITATION

During the first few days of the month rather widespread precipitation prevailed in much of the East and in the Lake region; however, the falls were moderate to light, except in a few localities in the Southeast, where thunderstorms occurred. During the latter half of the first decade heavy precipitation was received at many stations in the South from eastern Mississippi eastward and throughout the Atlantic Coast States, also some heavy falls were received at this time in central and northern California.

During the early part of the second decade generous to heavy precipitation was received in the Southeast and along the Gulf, and again during the latter part of this decade moderately heavy rain fell from Tennessee southward to the Gulf and over most of the Florida Peninsula. Some heavy falls also occurred in Arizona and California and other portions of the far Southwest, while moderate amounts were received in the Ohio Valley and throughout much of the Atlantic area.

Precipitation was general throughout much of the East during the greater part of the third decade, the falls being fairly heavy in portions of the Southeast during the early part of the decade, while toward the latter part moderately heavy rain fell in the west Gulf States and along the South Atlantic coast, and excessive amounts were received in much of the Florida Peninsula. Tampa, Fla., reported a fall of 5.62 inches for the 24 hours ending at 8 a. m. of the 29th. Moderate to generous amounts were received in the Northeast and portions of the Lake region and far Southwest, also the early portion of the decade saw considerable rain in the North Pacific region.

As a whole, the month was one of deficient precipitation. The shortage was especially marked, and was particularly unfortunate because of previous scarcity of moisture, in the middle Plains. Most of the middle Plateau and the North Pacific States, Oregon, especially, had notable shortages; likewise North Dakota, with eastern Montana and northern Minnesota.

There was mainly less precipitation than normal in the Missouri Valley, and less in all but a few small portions of the Mississippi and Ohio Valleys and the upper Lake region. Another region of shortage extended from the northern portions of Georgia and South Carolina to southern New England.

More than normal precipitation was received in the lower Lake region, northern New York, and most of New England; likewise in many portions of the Southeast, especially in central and northeastern Florida.

West of the Mississippi River there was more precipitation than normal in large portions of Montana, Idaho, and Wyoming, some parts of Texas and New Mexico, and most of Arizona and southern and central California.

The greatest amount so far reported, 12.88 inches, was noted at two stations, very far apart, one being in central Florida and the other in western Washington.

SNOWFALL

The snowfall was mainly less than the average amounts of previous March records. In those regions where moderate to considerable quantities are likely to occur the shortage was especially marked in those portions of the Middle Atlantic States lying to eastward of the Appalachian Divide, and in Minnesota, most of Iowa and the Dakotas, and the middle Plains.

More snow than usual was received from northeastern Missouri eastward and northeastward over much of the Ohio Valley, especially the northern and eastern parts, and over the lower and the southern portion of the upper Lake region. In these areas, especially near Lake Michigan, the most notable snowstorm of the month was particularly felt; this occurred about the 24th to 27th and was accompanied by high winds, resulting in serious drifting and great delay to traffic.

In the higher portions of the West the snowfall exceeded the normal in much of Montana, and in large portions of New Mexico, Arizona, and southern California; yet in these last-named States the normal amounts of March are not especially large. In the mountainous portions of the States of the Pacific Northwest the March snowfall was especially scanty.

The stored supply of snow in the high mountains of the West was mainly of disappointing quantity at the end of March. The districts with best prospects for a good summer flow were chiefly in the Rocky Mountains from northern Colorado northward.

RELATIVE HUMIDITY AND CLOUDINESS

The average relative humidity for the month was generally below the normal over most districts, except in some of the higher elevations of the Rocky Mountains, the northern portions of the Lake region, and extreme southern Florida, where the average humidity was mainly above the normal.

In much of the Gulf States, the upper Lake region, and the northern Rocky Mountain area, cloudy weather seems to have been more prevalent than usual, while in many of the central areas more clear weather than usual in March was noted.

SEVERE LOCAL STORMS, MARCH, 1930

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path yards [1]	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Skene, Miss.	6	4:30 p. m.	267	2	$20,000	Tornado	A number of residences and other small buildings demolished; 12 persons injured.	Official, U. S. Weather Bureau.
Kosciusko, Miss. (5 miles north of).	6	P. m.		1		do	A house and barn wrecked; 2 autos damaged; 2 persons injured.	Do.
Gregory, Ark.	6	P. m.			30,000	do	A number of buildings demolished; 5 persons injured.	Do.
Homer, La. (10 miles southwest of).	6	7:30 p. m.	300	1	10,000	do	Several homes demolished; path 8 miles long.	Do.
Robeline, La. (3 miles west of).	6	9:30 p. m.			5,600	Tornadic wind	Buildings and timber damaged over path 1 mile long.	Do.
Seman, Ala.	7	2 a. m.			4,500	Tornado	Some property damage.	Do.
Bellview, N. Mex.	14	3:15 p. m.	5 mi.			Hail	Small damage; too early for crops.	Do.
San Diego, Calif.	15	8 p. m.				Hail and wind	Some damage to tender plants and trees.	Do.
Webster County, Iowa.	16	8 p. m.			3,500	Tornado	Damage chiefly to buildings.	Do.
Harlan, Iowa.	16					Heavy hail	Much glass in greenhouses broken.	Do.
Arthur City, Tex.	18	4 a. m.				Wind	A house demolished, another moved from foundation, and several unroofed; 1 person injured.	Do.
Kossuth, Miss.	18					do	Considerable damage to dwellings and outbuildings.	Do.
Tennessee (central and eastern counties).	18			1	30,000	Destructive wind	Dwellings, churches, schools, timber, etc., damaged; 8 or [illegible] persons injured.	Do.
Montana (western), Idaho (northern), and Washington (eastern).	19	P. m.				do	Telephone and power lines damaged; trees uprooted; steel grain storage tank wrecked; several persons injured.	Great Falls (Montana) Tribune.
Headland, Ala.	19	9 p. m.			10,000	Tornado	Considerable damage to property; 1 person seriously injured.	Official, U. S. Weather Bureau.
Wisconsin and Michigan (southern) and northern Illinois and Indiana.	25–26					Heavy snow and wind.	Worst storm in history in some places; transportation of all kinds discontinued or delayed; schools closed.	Do.

[1] Mi. signifies miles instead of yards.